EUROGRAM

***E**UROPEAN **O**FFICE OF **A**EROSPACE **R**ESEARCH AND **D**EVELOPMENT*

September – October 2003

Contents

***Mr. Wayne Donaldson**; Aeronautical Science*

***Research Project Awarded:* "Research and Development of a Scaled Joined Wing Flight Vehicle"** to Professor Afzal Suleman, Instituto Superior Tecnico, Lisbon, Portugal. Several air vehicle configurations currently being studied by the Air Force include the use of joined wings. Joined wings offer the potential to reduce induced drag, provide high lift, provide good high altitude operation, and possibly reduce weight. Joined wing aerodynamics, especially aeroelastic behavior, is currently difficult to assess. Dr. Suleman and his research team have proposed to investigate the aeroelastic performance of the joined wing concept by analyzing, designing, manufacturing, and wind tunnel testing aeroelastically scaled models. The first step will include designing a test assembly to conduct aeroelastic flutter and gust response tests. A fairly flexible wing with low bending and torsion mode frequencies is envisioned in order to study the aeroelastic phenomena in a low subsonic regime. The structure of the joined wing will be analyzed to determine its vibrational behavior. Design aspects to be considered include spanwise loadings and design of wing camber and twist. A comparison of experimental and computational results will be conducted. Nonlinear structural issues will also be addressed. In order to predict the post-buckling behavior of the joined-wing structure, this task will concentrate on the development of higher-order geometric nonlinearity models for the joined-wing concept. Appropriate criteria will be

determined for (a) stiffness and weight effects on vehicle handling and flutter, and (b) ultimate strength and stability; (c) skin postbuckling and stringer column buckling of skin/stringer configurations, and (d) critical damage conditions associated with ultimate strength. AFRL/VA is co-funding this project.

Research Project Awarded: **"Development of a High-Order Discontinuous Galerkin Method for Multi-Physics Problems Governed by Hyperbolic Equations."** to Dr. John Ekaterinarius, The Institute of Applied and Computational Mathematics, Heraklion, Greece. Dr. Ekaterinarius will investigate and develop a method to solve the equations governing compressible magnetogasdynamics for use in transition and turbulent flow control. These problems are characterized by a large range of length scales, and therefore require high-order methodologies to provide adequate resolution. The method chosen, Discontinuous Galerkin method, has the advantage that it can provide high accuracy in localized regions. This will enable him to explore areas in detail (such as location of shocks), and use a relatively lower order scheme in regions where the flow is relatively smooth. The approach is very attractive and needs to be developed to compute flows at high-Reynolds numbers, where lower order methods are currently inadequate.

Research Project Completed: **"Aerodynamic Applications of Boundary Layer Control Using Embedded Streamwise Vortices"** by Dr. Nina Yurchenko, Institute of Hydromechanics, National Academy of Sciences, Kyiv, Ukraine. The objective of this project was to influence the boundary layer over an airfoil by using surface heating elements to induce streamwise vortices. Airfoils were manufactured to include arrays of streamwise heating elements, flush mounted over the convex and concave surfaces (Figure 1). The heating elements were made from 0.05 mm diameter tungsten wires with a spanwise spacing of 5mm. Wind Tunnel tests were conducted over a wide matrix of test conditions (Reynolds numbers from 1.5 $x10^5$ to $3.5x10^5$) and surface heating configurations. It was shown that the airfoil L/D could be improved by up to 8%. This project has been documented in several joint papers with AFRL/PRT with potential application to turbine blades and guide vanes.

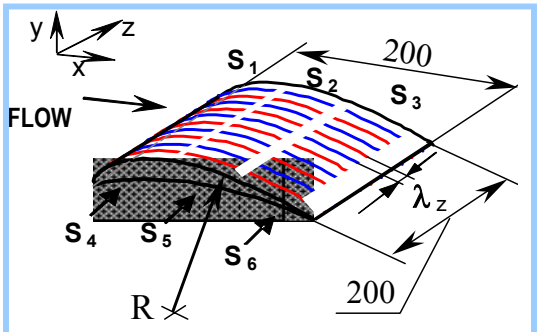


Figure 1. Airfoil showing arrays of streamwise heating elements.

Lt Col Valerie Martindale**;** *Life Sciences*

Research Organization Highlight: **Durmishidze Institute of Biochemistry and Biotechnology**, of the Georgia Academy of Sciences, has an extensive collection of extremophiles and is continually working to extend the collection and to characterize the organisms in it. An extremophile is an organism whose natural habitat is an extreme environment. Extremophiles are still on of the frontiers of biology. The existence of these organisms depends on complex uses of the laws of chemistry and physics that

are not seen in more temperate-dwelling organisms like ourselves. Because of this, extremophiles present the opportunity to find new biomolecules (proteins, lipids, oligonucleotides, polysaccharides, and combinations thereof, and potentially other classes for which we do not yet have names) with surprising properties, such as the ability to carry out chemical reactions in desiccating dryness or extremes of temperature. Extremophiles are hard to find and to collect, because humans need protective clothing and sometimes specialized equipment to reach them, and they are hard to maintain because their unusual lifestyles depend on maintenance of their extreme living conditions. The institute has recently embarked on a project titled "Creation of collection of extremophilic mycelial fungi isolated from all ecological niches of the Caucasus and elaboration of technologies based on their degradational, oxidizing, and synthesizing potential." As the title indicates, it is an ambitious project that will take many years. Along the way the payoffs will follow the pattern set by their ongoing characterization of extremophilic plants: new biochemicals and biochemical processes, including the occasional patent, and desirable organisms with novel DNA sequences, also potentially patentable. With modern techniques such as cloning and site specific mutagenesis, the researchers envision creation of simple organisms that thrive on environmental pollutants, and others that produce bulk quantities of high-grade industrial chemicals. Unfortunately, many of their publications to date are in Russian, but for a taste of their work, check out Kvesitadze, Adeishvili, Gomarteli, Kvachadze, and Kvesitadze, "Cellulase and xylanase activity of fungi in a collection isolated from the southern Caucasus," Inter. Biodeter. Biodegr. 43:189-196 (1999), and Kvesitadze, Nizharadze, Buachidze, and Kvesitadze, "Thermostability and Physicochemical Properties of Endo- and Exoglucanases of Thermophilic Microscopic Fungi," Biochemistry (Moscow) 62(2) (1997). The Institute, although in Georgia, is registered with the Science and Technology Center in Ukraine (STCU), through which commercial interactions with western partners can be arranged and audited and with whom EOARD is a registered partner. The Institute is eager to look into extreme environments of interest to western customers to see what they can find.

Site Visit: **Division of Physics of Biological Systems,** Institute of Physics, National Academy of Sciences in Ukraine, Professor Valery M Kharkyanen. The division's ambition is "to theoretically investigate the processes of dynamic self-organization and self-regulation in specific biological macromolecules. Then a general theory of structure self-organization and functional self regulation controlled by non-equilibrium parameters will be developed for biomacromolecules performing typical (redox, charge transfer, ligand binding, etc) reactions." Such a theory could provide the basis for predictive protein engineering leading to self-assembling macrostructures with the unique microstructural properties that so far can only be produced efficiently by living organisms. The theory is inherently tailored to the nanotech world, because of the scale of biomolecules. The group has published several papers in English on the first of their biomacromolecules, a bacterial photosynthetic reaction center. For an example, see Manzo, Goushcha, Scott, Kharkyanen, Christophorov, Barabash, and Berezetskaya, "Self-regulation phenomena applied to bacterial reaction centers 2: nonequilibrium adiabatic potential: dark and light conformations revisited," Biophys. J. 84:1146-1160

(2003). They are also registered with STCU and looking for western partners. They are willing to tailor the choice of their next biomacromolecule to suit a supporting partner.

Lt Col Chuck Ward**;** *Materials*

Research Project Awarded: **"Manufacture and Characterization of novel Carbon Fiber Reinforced Ceramics for Aircraft Brake Applications,"** to Surface Transforms, Cheshire, UK. A series of experiments will be carried out to establish conditions for producing new carbide carbon fiber-reinforced composites using Surface Transforms unique processing technique. These will include type and structure of the carbon-carbon fiber precursor composite, particle size shape and surface condition of the infiltration, and experimental conditions, including temperature and heating/cooling conditions of the sample. To establish and understand the effects of these changes, the samples will be sectioned and analyzed chemically and physically using SEM and optical microscopy. Samples will be tested for flexural strength, compressive strength, density, and thermal heat capacity to demonstrate their mechanical integrity. Frictional properties on a small-scale dynamometer will be measured.

Research Project Awarded: **"Thermodynamics and Self-assembly of Nanoscale Systems,"** to Prof. Leslie Woodcock, UMIST, Manchester, UK. Prof Woodcock will conduct a comprehensive review of the studies of thermodynamics of small systems, including under non-negligible gravity, and its application to processing. The goal is to develop a computer program that starts with input of the material's thermodynamic equations of state in the thermodynamic limit, and predicts the state and profiles of the inhomogeneous small system in a gravitational field. The program will predict the properties of a fluidized system of nano-particles and its phase and state behavior under gravity. The predictions of the program will be tested against a granular dynamics computer simulation of the steady-state properties of a system of nano-particles under gravity.

Research Project Awarded: **"Influence of Niobium on the Dynamic Recrystallization of Nickel,"** to Dr. Frank Montheillet, Ecole des Mines de Saint-Etienne, France. The project will study the influence of niobium in solid solution, without intermetallic precipitates, on dynamic recrystallization of high purity nickel. Nb plays an important role, although not well understood, on the hot deformation mechanisms of superalloys like Inconel 718. Alloys of 0, 0.1, and 1 weight percent niobium will be prepared and studied to determine their dynamic and post-dynamic recrystallization mechanisms and kinetics.

Research Project Awarded: **"Numerical Modeling of Penetration into a Compressible Viscoplastic Material,"** to Prof. Ioan Ionescu Universite de Savoie, France. Prof. Ionescu will develop new computational techniques and use them to gain fundamental understanding of the physical phenomena associated with penetration into a semi-infinite geological target of a hard (rigid) penetrator at intermediate impact velocities (typically, below 1000 m/s). The contractor we will implement viscoplastic models accounting for the combined effects of high strain rate and high confinement on

the response of geologic and cementitious materials. The focus will be on capturing increased hardening with compaction; diminished strain rate sensitivity with compaction; damage induced anisotropy; non-symmetrical strength effects in the target material and how these target properties affect the penetrator performance. Predictive capabilities for describing separation and damage ahead of the projectile will also result from this investigation. This effort is funded by AFRL/MN.

Conference Report: **EUROMAT 2003,** Lausanne, Switzerland, 1 - 5 September 2003. This is Europe's largest materials conference held every two years. This year's conference drew nearly 1500 participants and 1300 talks and posters.

Dr. J. Patsheider, EMPA, Dübendorf, Switzerland, presented an overview of ***nanostructure coatings***. The talk focused on using an unbalanced magnetron physical vapor deposition technique to create nanometer-scale laminates of TiN/NbN, TiN/Si_3N_4 and TiC/a-C:H (amorphous, diamond-like carbon). For the TiN/Si_3N_4 system, TiN is deposited with a nanometer grain size, while the Si_3N_4 is amorphous. A maximum hardness of 50 Gpa is observed when 15-20% of the laminate is the amorphous phase. This material also exhibits an oxidation rate approximately 20 times lower than TiN. For the TiC/a-C:H system, a maximum hardness is achieved with 10-15% amorphous phase, with a coefficient of friction of 0.32. Here, the diamond-like C transforms to a graphite-like film under load.

Dr. N. Brandon, Imperial College, London, UK, reported joint research conducted with CERES Power Ltd. on efforts in developing a ***solid oxide fuel cell*** (SOFC) that is to operate at intermediate temperatures near 600ºC. They recently demonstrated a power density of 300 W/cm^2 while operating at 550ºC. The SOFC is based on $Ce_{0.9}Gd_{0.1}O_{1.95}$ electrolyte. The overall system design, with an operating temperature of <600ºC, allows for use of ferritic stainless steel for supports, enhancing system durability. CERES has demonstrated stability of this system to 1700 hours.

Prof. Y. Bréchet, Univ. Grenoble, France, is working with Prof. M. Ashby, Univ. Cambridge, UK, to develop a systematic approach to ***materials selection***, and, eventually, ***materials design***. The approach requires a robust material and process database. Performance indices are assigned to the requirements, and a fuzzy logic approach is applied to the downselect process. Extension to materials development will use a genetic algorithm for downselect using material constituent properties and models.

Prof. K Maile, Univ. Stuttgart, Germany, presented an effort to produce a graded ***coating on C/C-SiC composites*** to provide oxidation resistance. The approach starts with Powder Immersion Reaction Assisted Coating (PIRAC, Technion Univ, Israel) to a TiC/TiN layer to the composite, sealing any prior defects and cracks. Following this, chemical vapor deposition is used to convert the outer surface to TiSi2, which provide the oxidation resistance.

Prof. J. Rösler, Tech. Univ. Braunschweig, Germany, described an electrochemical technique to produce highly regular ***nanoporous nickel superalloy foams***. The nickel superalloy (e.g. CMSX-4 in this case) is first exposed to temperature and stress to promote 'rafting' of the γ' precipitates. Electropolishing solutions and parameters can be chosen to either remove the γ matrix or γ' precipitates. The resulting structure produces complex channels approximately 300 nm wide. The thickest

material produced to date is 140 μm, and exhibited good flow of air. These materials may find application as filters for phase separation (e.g. biological), for heat transfer, catalytic substrates and porous substrates for functional thin films.

Dr. M. Wark, Univ. Hannover, Germany, reported on the creation of ***Pt and Co-filled nanotubes*** of SiO_2 and TiO_2. His group precipitates and grows a $[Pt(NH_3)_4](HCO_3)$ salt "template" nanofiber in an ethanol/water solution. The salt templates are rectangular in cross-section and measure ~100nm x 5mm. The templates are coated by a solgel technique to obtain the oxide coating. Afterwards, the tubes are calcinated to remove the ammonia. Calcination is done in air for Pt, but in H_2 for Co to avoid oxidation. The group observes Pt nano precipitates and nanowires within the SiO_2 nanotubes. As yet, the conditions to control the Pt morphology are not well defined. The group also believes metallic Pt is precipitated in TiO_2, but has been unable to confirm this by X-ray diffraction and believes it may be amorphous.

Prof. H. Böttcher, GMBU, Dresden, Germany, described his group's "***biocer***" materials, produced by embedding live bioorganisms (e.g. bacteria, yeast & fungi) by sol-gel processing within ceramic materials (e.g. SiO2). They have demonstrated growth of bacteria (bacillus sphaericus) in a silica matrix when exposed to a nutritional solution. One possible application of these materials is in ***bioremediation***. The group has demonstrated an ability to remove uranium from contaminated water when this material is used as a filter. The U can be desorbed and the material can be used 6 – 10 times. They also see application for their biocer materials as templates for nanostructured metal patterns.

Dr. H. Van Swygenhoven, Paul Scherrer Inst., Villigen, Switzerland, discussed a combined modeling and experimental approach to describing deformation of a ***Ni nanocrystalline*** material. She concluded that full dislocations are primarily responsible for deformation in Ni with a grain size of 25 nm. In tensile deformation, grain boundaries act as both source and sink for dislocations, leaving little to no dislocation residue in the matrix.

Conference Report: **6th International Charles Parsons Turbine Conference**, Trinity College, Dublin, Ireland, 16 – 18 September 2003. This conference is held approximately every three years, and this time focused on materials and design of industrial power generation. Approximately 100 people attended, with 74 talks presented. Most of the materials presentations focused on nickel- and steel-based alloys, though a few talks were also presented on coatings (thermal barrier and wear resistant), TiAl alloys, and ceramic matrix composites (SiC/SiC). Of the participating organizations, one of the most impressive in terms of output was the Rolls-Royce supported Cambridge University Technology Centre for Ni-Base Superalloys, headed by Dr. Sammy Tin.

Lt Col Carl Kutsche; Physics

Conference Report: **Nanotechnology in Security and Crime Prevention**, 28-29 Oct 03, London, UK. The conference was primarily dedicated to commercially available products to reduce theft and forgery loss. Notable presentations were made by Prof. Anthony Turner, Cranfield University UK on molecularly-imprinted polymers with

biological activity; Professor Victor Castano, Universidad Nacional Autonoma de Mexico; on high durability anti-graffiti (and anti bacterial) coatings;; and Professor W.E. Smith, Strathclyde University, Scotland, on Explosive Sensing and Electronic Nose Technologies.

Conference Report: **International Conference on Nanomaterials and Nanotechnologies (NN2003),** 30 Aug – 5 Sep 03, Crete, Greece. This conference assessed the current status and identified future priority directions of fabrication, research, design and applications of nanocomposites, carbon nanotubes, self-assembled supramolecules, nanostructured bulk solids, films and coatings, quantum dots and wires. About 200 researchers attended and a majority of the presentations were outstanding. Proceedings are expected March 2004 and will be available through the DTIC web site. If you would like a copy of the proceedings sent directly to you, please contact physics.nanotechnology@london.af.mil.

Research Project Awarded: **"Molecular magnetic quantum cellular automata"** to Michael Forshaw and Robert Stadler, University College London. The overall goal of this research is to dramatically extend the performance envelope of magnetic quantum cellular automata logic circuits into the molecular region. The work will involve theoretical analyses and computer modeling of systems and devices, at both the mesoscopic and molecular scale and to develop a theoretical description of molecular scale logic circuits using molecular magnets.

Research Project Awarded: **"Diluted magnetic semiconductors for magnetic field tunable infrared detector"** to Paul Harrison, School of Electronic & Electrical Engineering, The University of Leeds, UK. Dr. Harrison will investigate the basic science underlying the tune-ability of HgMnTe by making use of the Zeeman effect (magnetic shifts of the band-edge). Initial measurements have shown shifts of 15 meV for the conduction band edge and 60 meV for the valence band edge.

Research Project Awarded: "**Nematic Elastomer Nanocomposites"** to Dr E.M. Terentjev, Cambridge University. Dr. Terentjev seeks to develop a new concept of composite materials based on liquid crystal elastomer networks with low concentration of embedded aligned carbon nanotubes, with the aim of obtaining electro-mechanical actuation effect. Aspects of preparation, characterization and practical utility of these actuators, as well as the fundamental questions of mechanisms behind the effect, will be the focus of this project.

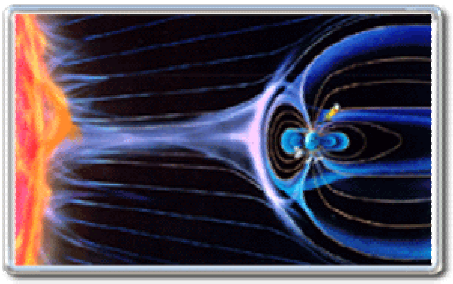
Lt Col Michael Milligan**;** *RF Technology*

Conference Report: **COST271 Workshop: Effects of the Upper Atmosphere on Terrestrial and Earth-Space Communications**, was held in Spetses, Greece, 23-27 September 2003. The objectives of the COST 271 project (European Co-operation in the field of Scientific and Technical Research) are to stimulate international cooperation in predicting and forecasting the ionosphere and plasmasphere; to develop and implement new communication services; to minimize the effects ionospheric

perturbations have on communications systems; and to collect new data for now-casting and forecasting. This workshop, organized by the National Observatory of Athens, focused on four separate areas: "Impact of variability of space environment on communications," "Assessment of space plasma effects for satellites applications," "Ionospheric effects on terrestrial communications," and "Space plasma effects on Earth-space and satellite to satellite communications." Results of research and planned experiments were presented in each area. EOARD supported this workshop and as a result, three American scientists were invited to attend. This was significant since this is usually a European-only workshop. AFRL attendance was significant, as preliminary plans for future collaborations and research projects were discussed.

Conference Report: **ICATT '03, 4th International Conference on Antenna Theory and Techniques**, was held in Sevastopol, Ukraine, 9-12 September 2003. This conference was supported by EOARD, and brought together researchers from 16 counties (but primarily from Ukraine and Russia). Papers were given on various aspects of general antenna theory, antenna synthesis, adaptive arrays, reflector and lens antennas, signal processing remote sensing, radomes, measurement techniques and computational methods. Several contacts were made, and one resulted in an unsolicited research proposal in the area of Terra Hertz radiation using Josephson Junctions and Gunn Diodes.

Site Visit: University of Birmingham, Birmingham, UK to assess progress on current research activities. Professor George Simnett, Department of Physics, is funded by EOARD to conduct research on forecasting the arrival of coronal mass ejections (CME) at the Earth. CMEs have the potential to cause geomagnetic storms, which not only disrupt radio communications, but have also have the ability to damage or even destroy Earth-orbiting spacecraft. Professor Simnett's team will investigate data collected on CMEs (using the Solar Mass Ejection Imager (SEMI) instrumentation onboard the USAF CORIOLIS Spacecraft), and attempt to construct images of CMEs as they move towards the earth and predict their arrival. The objective of this research is to create a mathematical model for predicting the arrival and severity of geomagnetic storms resulting from CMEs. In addition, a visit was made with Professor Mikhail (Mike) Cherniakov, Department of Electrical Engineering, to assess potential research projects on bistatic radar techniques using transmitters of opportunity (in this case, GPS).



Site Visit: Trinity College, Dublin, Ireland. Professor William Coffey, Department of Electrical Engineering is currently working under an EOARD research grant. His research focuses on mathematically solving the stochastic Langevin equations. These equations can be used to describe the behavior of magnetic particles. This research can be applied to increasing magnetic particle density that can be used to increase the ability to store information, particularly for particles that are in a quasi-superconductive state.

Research Project Awarded: **"Transverse Resistivity of YBCO Coated Conductors for AC Use"** to Dr. Milan Polak, Dept. of Electrodynamics of Superconductors, Institute of Electrical Engineering, Bratislava, Slovak Republic. Dr. Polak will identify and characterized factors affecting transverse resistivity of filamentary YBCO (Yttrium Barium Copper Oxide) coated conductors and to study methods to control them. Scientists are interested in YBCO because when cooled to below 90 Kelvin, (which can be accomplished using liquid nitrogen), it becomes a superconductor. This type of material could be used to reduce weight of airborne electrical power generators and transformers by 5 to 10 times. However, at typical aircraft power system frequencies (400 Hz), it is difficult to sustain superconductivity because of the high losses imparted by oscillating magnetic fields and currents. This research will attempt to mitigate these losses by several orders of magnitude by investigating the optimum separation of superconducting filaments

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Dr. Ingrid Wysong; *Space Technology*

Conference Report: **"Workshop on Chemical Oxygen Iodine Laser Research,"** sponsored by AFRL/DEL and EOARD, 20-21 October 2003, Stuttgart, Germany. The 25 attendees are participants in COIL-related research contracts from Russia, Israel, Germany, and Czech Republic, as well as the US.

Site Visit: **Institute for Raumfahrtsysteme**, Univ. Stuttgart, Germany. This institute, headed by Prof. Monica Auweter-Kurtz, is a leader in thermal protection testing and electric propulsion. They also study thermal protection materials and especially the physics of surface catalycity. They have several large, high-power plasma wind-tunnels with a range of optical, electric, and thermal diagnostics.

Conference Report: **International Astronautics Congress**, 29 Sept – 3 Oct, Bremen, Germany. This is the single largest European meeting on space technology, with papers on the whole range of topics, from propulsion and debris to guidance and control. Congratulations go to USAF Maj Fred Kennedy, currently pursuing his doctorate at Univ. Surrey, UK, for winning the best student paper award! Title: "*A comparison of simulation and test campaign results for a microscale solar thermal engine*."

Conference Support

EOARD promotes technical interchange by supporting and co-sponsoring technical workshops and mini-symposia at overseas conferences. We often receive, in return for sponsorship, proceedings and free conference registration for one or more Air Force representatives. Air Force R&D personnel attending or considering attending European conferences or seeking further details on the conferences listed below contact the program manager indicated (see footnotes). **Bi-service and tri-service support efforts** are in bold print. A listing of conferences is also available at the AFOSR conference web page.

Dates	Location	Title
Aeronautical Science; Mr. Wayne Donaldson		
29 Mar - 2 Apr 04	Athens, Greece	Tenth International Symposium on Gaseous Dielectrics
22 - 27 Aug 04	Mragowo, Poland	9th Symposium on Polymer Electrolytes (ISPE 9)
Information Technology and C4I; Dr. Chris Reuter		
14 - 19 Jun 04	Samara, Russia	Complex Systems: Control and Modeling Problems
Life Sciences; Lt Col Valerie Martindale		
29 Sep - 1 Oct 04	Toulouse, France	International Conference on Human-Computer Interaction in Aeronautics (HCI-Aero 2004)
Materials; Lt Col Chuck Ward		
20 - 25 Jun 04	Szklarska Poreba, Poland	Molten Salts Conference Euchem 2004
Physics; Lt Col Carl Kutsche		
1 - 5 Dec 03	Colonia del Sacramento, Uruguay	Workshop on Noise, Chaos and Complexity in Lasers and Nonlinear Optics
4 - 5 Feb 04	Naples, Italy	Laser applications to surface cleaning and conditioning for aerospace operations
21 - 24 Mar 04	Chamonix, France	International Conference on Alternative Substrate Technology IV
14 - 17 Dec 04	Aruba	Workshop on Frontiers in Electronics (WOFE) 2004
Sensors and RF Technology; Lt Col Michael Milligan		
20 - 23 Jun 04	Oulu, Finland	First International Symposium on Space Climate: Direct and Indirect Observations of Long-term Solar Activity
2 - 6 Aug 04	Turku, Finland	Chapman Conference on Solar Energetic Plasmas and Particles
Space Technology; Dr. Ingrid Wysong		
5 - 7 Apr 04	Oxford, UK	Faraday Discussion 127: Non-adiabatic Effects in Chemical Dynamics
11 - 16 Jul 04	Bari, Italy	24th International Symposium on Rarefied Gas Dynamics
30 Aug - 3 Sep 04	Prague	GCL-HPL XV

Window on Science

EOARD initiates and promotes technical liaison between Air Force and foreign scientists very effectively with the Window On Science (WOS) program, through which we can arrange and fund visits of foreign scientists to selected Air Force facilities. To nominate a WOS candidate, contact your Technical Director or your EOARD discipline representative. WOS visitors currently on contract are listed below. For further details contact the program manager indicated (see footnotes).

Date	Traveler	Country	Subject	Location of Visit(s)
Aeronautical Science; Mr. Wayne Donaldson				
Dec 03	Prof V. Pan	Ukraine	Critical current density in single-crystal high temperature superconducting films	AFRL/PRPG, WPAFB OH
Dec 03	Dr. A.L. Kuranov	Russia	Highly Effective Catalysts for the Thermochemical Heat Regeneration and Hydrocarbon Reforming	AIAA Conf, Norfolk VA
Dec 03	Dr. A. Korabelnikov	Russia	Catalytic Elements of Active Thermal Protection	AIAA Conf, Norfolk VA
Jan 04	Dr. Y.F. Kolesnichenko	Russia	Basics in Beamed Microwave Energy Deposition for Flow/Flight Control	AIAA Conf, Reno NV
Jan 04	Dr. R.K. Nangia	United Kingdom	Design of High Aspect Ratio Lambda-wings Incorporating Laminar Flow	AIAA Conf, Reno NV
Jan 04	Prof A. Krasilnikov	Russia	MHD Effect Study at High Frequency Plasmatron	AIAA Conf, Reno NV
Jan 04	Prof I. Golovatchev	Russia	Simulation of Pulse-Mode Regime of magnetohydrodynamics (MHD) Section of the Shock Tube.	AIAA Conf, Reno NV
Jan 04	Dr. I. Mashek	Russia	Microwave Discharge Initiated by Laser Spark in Air	AIAA Conf, Reno NV
Jan 04	Prof N. Molevich	Russia	Acoustic Props of Nonequilibrium Media	AIAA Conf, Reno NV
Jan 04	Dr. K.V. Khodataev	Russia	Basis of the high ability of the streamer MW discharge to a resonant absorption of MW radiation.	AIAA Conf, Reno NV
Jan 04	Dr. V. Levin	Russia	Bow Shockwave Structures Control by Pulse-Periodic Energy Input	AIAA Conf, Reno NV
Jan 04	Dr. E. Cheikine	Russia	Magnetohydrodynamic MHD Controlled Inlet for Scramjet with Various Configurations of Magnetic Field	AIAA Conf, Reno NV
Jan 04	Dr. S. Bobashev	Russia	Supersonic Flow Control by Magnetic Field	AIAA Conf, Reno NV
Jan 04	Dr. A. Ershov	Russia	Probe Diagnostics of Discharge and Flame Plasmas in Supersonic Air-propane Flows	AIAA Conf, Reno NV
Jan 04	Dr. S. Leonov	Russia	Study of Friction Control by Surface Plasma.	AIAA Conf, Reno NV
Jan 04	Dr. A.L. Kuranov	Russia	Scramjet with magnetohydrodynamic (MHD) Bypass under AJAX Concept.	AIAA Conf, Reno NV
Jan 04	Dr. I. Timofeev	Russia	Transversal Direct Current Discharge in High Press Gas Supersonic Flow	AIAA Conf, Reno NV
Jan 04	Dr. V. Bityurin	Russia	Expr and Theoretical Study of MHD Interaction in Hypersonic Ionized Air Flow Over a Wedge	AIAA Conf, Reno NV
Jan 04	Prof I. Kossyi	Russia	Long-Lived Plasmoids as a Combustion Ignitor	AIAA Conf, Reno NV
Jan 04	Dr. V. Lashkov	Russia	Gas Dynamic Effect of Microwave Discharge on Supersonic Cone-shaped Bodies	AIAA Conf, Reno NV

Jan 04	Prof. B.Yu. Zanine	Russia	Plasma Control of Separated Flow Asymmetry on a Cone at High Angles of Attack	AIAA Conf, Reno NV
Jan 04	Dr. A. Maslov	Russia	Nonlinear aspects of hypersonic boundary layer stability on a porous surface	AIAA Conf, Reno NV
Jan 04	Dr. I. Esakov	Russia	Determination of the Microwave Threshold Parameters Using a Streamer Discharge	AIAA Conf, Reno NV
Jan 04	Prof V.L. Bytchkov	Russia	Plasma Jet Generators with Divergent Channel for Aerodynamic Apps	AIAA Conf, Reno NV
Jan 04	Prof V. Shibkov	Russia	Microwave Discharges in Supersonic Plasma Aerodynamics	AIAA Conf, Reno NV
Jan 04	Dr. A. Klimov	Russia	'External and Internal Plasma- Assisted Combustion'	AIAA Conf, Reno NV
Jan 04	Dr. M. Allan	United Kingdom	WIND TUNNEL INTERFERENCE EFFECTS ON A 70 DEGREE DELTA WING	AIAA Conference, Reno NV and AFRL/VA, WPAFB
Jan 04	Dr. B. Noack	Germany	Flow Modeling and Flow Control Theory at the Technical University of Berlin	AFRL/VA, WPAFB OH, and Ohio State University
Jan 04	Dr. A. Fedorov	Russia	Direct Numerical Simulation of Unstable Disturbances in Supersonic Boundary Layer	AIAA Conference, Reno NV
Jan 04	Dr. S. Starikovskaia	Russia	Nonequilibrium Plasma Formation by High-Voltage Pulsed Nanosecond Gas Discharge	AIAA Conference, Reno NV
Jan 04	Prof V. Kuchinskiy	Russia	Improvement of flying vehicle aerodynamic quality by the energy deposition in a stream.	AIAA Conference, Reno NV
Jan 04	Dr. A. Starikovskii	Russia	Ignition of Hydrogen-Air and Methane-Air Mixtures by Nanosecond High-Voltage Nanosecond Discharge	AIAA Conference, Reno NV
Jan 04	Dr. V. Brovkin	Russia	Microwave Discharge Control by Magnetic Field	AIAA Conference, Reno NV

Life Sciences; Lt Col Valerie Martindale

Dec 03	Dr. N. Chemeris	Russia	Genotoxic Effects of High Peak-Power Pulsed Electromagnetic Fields	AFRL/HEDR, BAFB, TX; Electromagnetic Safety 2003 Conf, San Antonio, TX
Jan 04	Dr. P. Gajsek	Slovenia	Eastern European EMF Standards	Asia-Pacific Electromagnetic Field Conf, Bangkok
Jan 04	Prof D. Leszczynski	Finland	Use of high-throughput screening techniques to elucidate cellular targets of EMF	Asia-Pacific Electromagnetic Field Conf, Bangkok
Jan 04	Dr. P. Chadwick	United Kingdom	Specific Absorption Ratios from TETRA radios and accessories	Asia-Pacific Electromagnetic Field Conf, Bangkok
Jan 04	Dr. S. Johnston	United Kingdom	Research Criteria for RF research epidemiology, in vivo, in vitro	Asia-Pacific Electromagnetic Field Conf, Bangkok
Jan 04	Dr. M. Hietanen	Finland	ICNIRP's activities and approach to EMF protection	Asia-Pacific Electromagnetic Field Conf, Bangkok
Jan 04	Dr. C. Marino	Italy	Mobile Telephony and Health in Italy	Asia-Pacific Electromagnetic Field Conf, Bangkok
Jan 04	Dr. B. Veyret	France	Experimental research on bioeffects of RFR	Asia-Pacific Electromagnetic Field Conf, Bangkok

Materials; Lt Col Chuck Ward

Dec 03	Prof S.Z. Margel	Israel	Nano and micron-scaled particles and applications	AFRL/MLP, WPAFB, OH

Jan 03	Prof A. Ustinov	Ukraine	Damping Coatings for Titanium Alloys	GE Aircraft Engines, OH; AFRL/PR, WPAFB, OH
Jan 03	Prof B. Movchan	Ukraine	Damping Coatings for Titanium Alloys	GE Aircraft Engines, OH; AFRL/PR, WPAFB, OH
Jan 04	Prof V. Konov	Russia	Laser Assisted Processing of Polycrystalline Diamond Films	NRL, Washington, DC; AFRL/MLB, WPAFB OH
Mar 03	Prof F.J. Humphreys	United Kingdom	Microstructure and texture during TMP of aluminum alloys	AFRL/MLL, WPAFB, OH

Physics; Lt Col Carl Kutsche

Nov 03	Dr. M.T. Petkovska	Yugoslavia	Rigorous mathematical modeling electrothermal regeneration of used adsorbents	AFRL/MLQ, Tyndall AFB, FL; AIChE Fall Meeting 2003, San Francisco, CA
Nov 03	Dr. M.A. Odnoblyudov	Russia	Impurity Based Electroluminescence in Wide Bandgap Semiconductors	AFRL/SNH, Hanscom AFB, MA; Univ. of Delaware, Newark, DE
Dec 03	Prof R. Stoian	Germany	Optimized laser material processing by temporally tailored ultrafast laser pulses	AFRL/MLPJ, WPAFB OH
Jan 04	Dr. V. Venediktov	Russia	Dynamic Holographic Correction using Liquid Crystal Valves in the Infrared	Univ of NM, Albuquerque, NM and Electronic Imaging Conf San Jose, CA
Feb 04	Prof T. Glynn	Ireland	International Conference on Laser Applications for Aerospace Sustainment Solutions	Laser Applications for Aerospace Sustainment Solutions, Naples, Italy

Sensors and RF Technology; Lt Col Michael Milligan

Dec 03	Dr. J.D. Halbritter	Germany	Effects of Ca doping on superconductors	AFRL/SNHA, Hanscom AFB, MA
Dec 03	Prof A. Petrosyan	Russia	Aircraft measured turbulence data and effects on microwave and infra-red propagation.	AFRL/VSBL Hanscom AFB, MA
Jan 04	Prof V.I. Perevodchikov	Russia	Investigation of Characteristics of High-Power Wide-Band Plasma-Filled Traveling-Wave Tubes (TWT)	University of Maryland, Institute for Research in Electronics and Applied Physics

Space Technology; Dr. Ingrid Wysong

Jan 04	Prof M.S. Ivanov	Russia	Numerical Study of Spacecraft Contamination Problems Associated Thruster Plume Flows	AIAA Aerospace Sciences Mtg, Reno, NV; AFRL/PR personnel at USC
Jan 04	Prof S.T. Surzhikov	Russia	Direct Current Discharge Interaction with Supersonic Gas Flow	AIAA Conference, Reno NV
Jan 04	Dr. G. Karabadzhak	Russia	Analysis of new spacecraft plume glow data taken onboard Mir space station	AIAA Aerospace Sciences Mtg, Reno, NV; AEDC, TN
Jan 04	Prof M.S. Ivanov	Russia	Numerical Study of Spacecraft Contamination Problems Associated Thruster Plume Flows	AIAA Aerospace Sciences Mtg, Reno, NV; AFRL/PR personnel at USC
Feb 04	Dr. G. Fontana	Italy	Propulsion based on High Frequency Gravitational Waves	Space Tech and Appl's Intnl Forum, Albuquerque, NM

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